IMPERIAL CHEMICAL INDUSTRIES LIMITED
PETROCHEMICALS DIVISION

SAFETY NEWSLETTER No.95

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95/1 WHAT YOU DON'T HAVE, CAN'T LEAK OUT

The Company has just issued the most forward-looking and encouraging report on safety that I have seen in nearly ten years in this job. It is the report of a seminar on the design of intrinsically safer plant and equipment, Process Safety Report No 8, "Seminar: Development of Intrinsically Safer Plants and Processes, October 1976", Report No HO/S 0/740009/8/B.

"Intrinsic Safety" does not sound very exciting. What do these words mean?

The usual way of making a plant safe is:

To design it

To try to think of all the hazards

To find ways of keeping them under control, usually by adding on extra safety equipment.

For example, if our plant contains a lot of flammable gas we may

— try to keep it in by good design

— install gas detectors so that we know when any gets out

— install emergency valves to isolate sources of leak

— build the plant out-of-doors and space it well so that leaks disperse easily and perhaps supplement natural ventilation by steam or water curtains

— protect the plant against fire with insulation and water spray

— provide fire-fighting equipment.

This is just some of the safety equipment which is added on to many plants, to make them extrinsically safe.

A better solution might be to find processes which use safer raw materials and intermediates, or not so much of the hazardous ones. This is known as intrinsically safe design.

For example, the most dangerous items in our houses are the stairs; more people are killed or injured on them than in any other way. Traditional or extrinsically safe ways of controlling the hazard would be to add hand-rails or to make sure the carpet is not loose. The intrinsically safe solution is to buy a bungalow.

The papers and discussion at the seminar described some cases in which intrinsically safe design has been used (see Newsletter 67/1), some cases in which we are trying to use it, and some cases in which we think we ought to use it (see the Supplement to Newsletter 75). There was also a discussion on the constraints that prevent us moving faster.

Why is intrinsically safe design better?

Henry Ford once said, "What you don't fit costs nothing and needs no maintainence". If we do not have to use so much hazardous material, we do not have to fit so much of the safety equipment listed earlier, we do not have to maintain it, we do not have to spend a lot of effort making sure that people use it properly and it will be easier to convince the Factory Inspectorate that the plant will not blow up.

In addition, there is another saving that could be much greater. If we do not need such large inventories of hazardous liquids we do not need such big vessels to keep them in, such big pipelines to move them, such big structures to support the vessels or such big foundations.

The picture on the front shows the building housing the two 1868 steam-driven beam engines and associated boilers at Ryhope near Sunderland. They were used to pump water out of a well for the town supply. The engines are still in working order and the building is now a museum.

Today for the same duty (a million gallons per day raised through 250 feet) we would use a submersible electric motor pump set located in the borehole. The motor and pump would be about 8 feet long by 2 feet diameter, much smaller than the Ryhope machines — and much cheaper, and no building would be needed to house them.

The plants we are now designing or operating, with their large vessels and inventories, may seem to us to be in the forefront of technology. Perhaps they are really Ryhope pumping engines and our children or grandchildren will be starting a society to preserve the last large pressure still in Cleveland, so that it can be viewed by the public at weekends and circulated on Bank Holidays.

The Ryhope engines are on view at weekends and on Bank holidays from Easter to September and are steamed several times per year. They have been mentioned to show that change in technology can produce reductions in size and thus cost. I am not implying that they are less safe than modern machines.

[After this Newsletter was written we described the plants as inherently safer rather than instrinsically safer to avoid confusion with intrinsically safer electrical equipment.]

95/2 A SUB-STANDARD BRANCH ON PROPRIETARY EQUIPMENT SNAPS OFF AND CAUSES A LEAK

A pipeline had to be plugged by welding on a branch and then using proprietary cut and stopple equipment. When the job was almost complete a ¼ inch screwed branch and valve on the equipment snapped off and the liquid in the pipeline sprayed out. Fortunately, the pressure in the pipeline was much lower than usual and no-one was injured by the spray. However, there was no easy way of stopping the leak and it continued for some time.

A scaffold plank had been resting against the ¼ inch valve and an increase in pressure, possibly someone stepping on the plank, caused the branch to snap off.

We would not have allowed a ¼ inch screwed fitting directly on a process line — the plant on which the incident occurred is a modern one and all branches are welded or flanged up to the first isolation valve and all branches are 1 inch or larger for robustness — but no-one noticed there was a thin screwed branch on the proprietary equipment.

When using proprietary equipment make sure it conforms to our standards.

Before temporary equipment is attached to a plant, plan what to do if a leak occurs.

95/4 IF SOMETHING IS GOOD, MORE OF IT MAY NOT BE BETTER

As children we were told that, although apples are good for us, too many make us ill. The same is true of many things — trip testing for example.

An explosion occurred recently in a plant in another company where oxygen and a hydrocarbon are mixed together. A trip system measures the amount of oxygen present and shuts off the supply if it gets too high.

One day the oxygen content got too high while the trip system was out of action for its daily test and an explosion occurred. Ten people were injured, fortunately not seriously, and about £2M of damage was caused.

The daily test took over an hour, so the trip system was out of action for testing for one-twentieth of the time. There was therefore a chance of one in twenty that it would not prevent an explosion because it was being tested!

As I have often pointed out (see Newsletters 76/6 and 28/2) trip systems must be tested or they may not work when required — monthly testing is common. But too much testing may mean that the trip is out of action for too long.

If daily testing was really necessary, then a duplicate trip system should have been provided so that one was on line while the other was being tested.

95/5 SOME QUESTIONS I AM OFTEN ASKED

26—WHICH AIRLINE SHOULD I FLY?

Assuming you wish to choose the airline most likely to get you there alive, rather than the one with the best food or prettiest girls, then the information needed to answer this question can be found in a recent book, “Destination Disaster”, by P Eddy, E Potter and B Page, Hart-Davis and MacGibbon, London 1976, price £4.95. Most of the book is about the 1974 Turkish Airlines DC-10 crash, but Appendix C lists all air crashes known to have occurred in the 25 years from 1950 to 1974 and works out, for each airline, deaths per million passengers and deaths per 10^9 passenger-kilometres.

In the table below, the airlines have been divided into six groups, group one being the safest and group six the least safe. The allocation is based mainly on the deaths per million passengers, but some allowance has been made for the average length of journey and more weight has been given to recent accidents than to earlier ones.

AIRLINES GROUPED BY SAFETY RECORD 1950-1974

If you fly in a group two airline instead of a group one airline, the chance that you will be killed is doubled. In group three it is doubled again and so on.

The figures in brackets are deaths per million passengers.

An asterisk shows that no passengers were killed in the last ten years of the period covered.

GROUP 1

1	TAP (Portugal)	(0)*	9	United	(1.6)
2	Quantas	(0.6)*	10	Ansett (Australia)	(0.9)
3	Delta	(0.6)	11	National	(2.0)
4	American	(1.1)	12	Lufthansa	(1.9)
5	SAS	(0.8)	13	Eastern	(1.2)
6	Trans-Australian	(0.6)	14	Iran Air	(3,4)*
7	Japan Air Lines	(1.9)	15	Braniff	(2.1)
8	Continental	(0.7)*			

GROUP 2

1	Aeromexico	(3.8)	7	Swissair	(2.2)
2	TWA	(3.2)	8	British Airways	(4.5)
3	New Zealand National	(1.0)*	9	KLM	(7.3)*
4	AirCanada	(2.8)	10	Hughes Airwest	(2.1)
5	Pan Am	(4.0)	11	Allegheny	(2.3)
6	El Al	(8.2)	12	Aer Lingus	(3.8)

GROUP 3

1	Northwest	(4.0)	10	Olympic	(6.3)
2	Iberia	(4.8)	11	Mexicana	(4.7)
3	Alitalia	(4.9)	12	Cathay Pacific	(11.4)
4	LAN (Chile)	(11.6)	13	South African	(8.1)
5	East African	(7.9)	14	Ethiopian	(3.8)
6	SABENA	(8.3)	15	Canadian Pacific	(11.4)
7	JAT(Yugoslavia)	(6.6)	16	Air France	(9.1)
8	Finnair	(2.5)	17	British Caledonian	(4.8)
9	All Nippon	(4.5)	18	Icelandair	(9.0)’

GROUP 4

1	Cubana	(9.9)	9	Air Algerie	(9.0)
2	Austrian	(3.8)*	10	LOT (Poland)	(7.9)
3	AVIANCA (Columbia)	(9.0)	11	Garuda (Indonesia)	(10.1)
4	VARIG (Brazil)	(12.5)	12	Aero.Argentinas	(17.2)
5	Pakistan International	(16.7)	13	CSA (Czechoslovakia)	(11.4)
6	Indian Airlines	(11.4)	14	Philippine	(10.6)
7	UTA (France)	(20.1)*	15	Air India	(31.6)
8	Cruzeiro (Brazil)	(10.0)			

GROUP 5

1	AVIACO (Spain)	(15.3)	3	Middle East Airlines	(16.5)’
2	Nigeria	(26.3)	4	Turkish Airlines	(28.7)

GROUP 6

1	TAROM (Rumania)	(26.1)	3	VIASA (Venezuela)	(52.2)
2	Egyptair	(44.7)	4	ALIA-Royal Jordanian	(156.0)

Many small airlines which have never had an accident have been excluded, as the total number of passengers they have carried is too small to be significant.

Aeroflot (Russia) is excluded as data are not available.

Care is needed in using the figures in the table as:

1 They describe past, not future, performance. Changes in management policy may cause an airline’s record to improve or fall. For example, Air France was once known as Air Chance, but had no accidents in the last six years of the period covered.

2 Many accidents are due to faults in the planes or in airport facilities. On the other hand the figures show that some airlines are better than others at choosing safe planes or coping with bad airports.

3 VIASA (Venezuela) is a small airline. Its poor record is the result of one serious accident. Bad luck may have put it into group six. For most airlines the samples are large enough to be fair and the table does show that the three Australian airlines and many of the major US airlines have outstandingly good safety records. Either they pay more attention to safety than other airlines or they are technically more competent (or both).

Finally, do not get too worried. Even if you fly by Royal Jordanian Airlines it is 99.984% probable that you will arrive.

95/6 UNUSUAL ACCIDENTS No 62

In July 1975 the Wisconsin Natural Gas Company employed a contractor to install a 2 inch 58 psig plastic natural gas main along 20th Avenue, Kenosha. The contractor used a pneumatic boring technique and in doing so bored right through a 6 inch sewer pipe serving one of the houses in the avenue.

The occupant of the house, finding that his sewer was obstructed, engaged another contractor to clear it. The contractor used an auger and ruptured the plastic gas pipe. Within 3 minutes the natural gas had travelled 40 feet up the sewer pipe into the house and exploded. Two people were killed and four injured, the house was destroyed and the houses on either side were damaged.

After the explosion it was found that the gas main had passed through a number of other sewer pipes.

Is this another example of a failure to foresee the results of a change in technology? (See Newsletters 83 and 88/1).

From a note issued by the US National Transportation Safety Board on 12 November 1976.

95/7 RECENT PUBLICATIONS

(a) Plastics Division Safety Department Information Note No 3 describes the hazards of inert gases and oxygen deficiency and supplements the information given in Newsletters 88/4, 55/1, 25/3,22/1 and 3/6.

(b) J & S Sieger Ltd. manufacturers of combustible gas detectors, have published a list of flammable liquids and gases and their properties which gives the various different values that have been reported for the lower explosive limits. Copies of the list are available from 31 Nuffield Estate, Poole, Dorset, BH17 7RZ.

(c) Safety Newsletters 83 to 94 have been re-issued as a bound volume and can be obtained from Division Reports Centres by asking for Report No. PC.200,844/A.

For a copy of (a) or for more information on any item in this Newsletter please ‘phone ET. (Ext. P.2845) or write to her at Wilton. If you do not see this Newsletter regularly and would like your own copy, please ask Mrs T. to add your name to the circulation list.

I would like to thank all who have sent me congratulations on my appointment as a Senior ICI Research Associate; the first time, I think, one has been appointed outside the normal R & D field.

Any success I have achieved has been due to the help I have had from the many people who have been willing to listen to my ideas and try them and to the many people who have allowed me to describe their mistakes in these Newsletters. My thanks are due to you all.

TREVOR A KLETZ

Division Safety Adviser

January 1977

Who's Who in Safety?

No. 9—D ANDREW

Despite his name, Duncan Andrew, Technical Safety Manager at Nylon Works, Ardeer, comes from Manchester and was educated at Lancaster Royal Grammar School and at the Royal School of Mines. He joined the National Coal Board, obtaining a first class certificate of competence in mine management, and held various positions from deputy to under-manager at a number of collieries, most of which have now closed, not, we hope, because of his influence.

Seeing little prospect of promotion in the coal industry, Duncan applied to ICI Dyestuffs Division in 1966 for a job as a Productivity Services Officer. Someone noticed that he had spent 1 8 months as a Safety Engineer at Mosley Common Colliery — now closed, but once the show pit of the North —and he was offered an appointment as Construction Safety Officer at Ardeer. He pin-pointed Ardeer on the map, never having heard of it before, and moved north to join the staff at the then new Nylon Works, where he is now Technical Safety Manager.

His interests are lapidary, hill walking and stamp collecting. He plays squash, despite suggestions that this is not a sport, more a funny story.

Duncan is married with a daughter and a son.